

WHAT IS CLAIMED IS:

1. An active anti-vibration apparatus comprising:
an anti-vibration table;
a movable portion mounted on said anti-vibration
5 table;
a pneumatic spring for supporting and driving said
anti-vibration table;
a servo valve for adjusting a pressure of said
pneumatic spring;
10 an electromagnetic actuator for applying a force to
said anti-vibration table;
a displacement sensor for detecting displacement of
said anti-vibration table;
an anti-vibration table displacement controller for
15 generating a driving signal for said servo valve on the
basis of an output from said displacement sensor so that
said anti-vibration table keeps a predetermined posture at
a predetermined position; and
an anti-vibration table vibration controller for
20 generating a driving signal for said electromagnetic
actuator,
wherein both said servo valve and said
electromagnetic actuator are so controlled as to compensate
for movement of a load that occurs when said movable portion
25 moves on said anti-vibration table.
2. The apparatus according to claim 1, wherein said
movable portion is a stage mounted on said anti-vibration

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table, and

the apparatus further comprises

driving means for driving said stage,

a position sensor for detecting a position of said

5 stage, and

a stage position controller for controlling the position of said stage on the basis of an output from said position sensor so as to coincide with a predetermined target position.

10 3. The apparatus according to claim 1, wherein said electromagnetic actuator applies to said anti-vibration table a force in at least one of the same direction as a support direction of said pneumatic spring and a direction perpendicular to said same direction.

15 4. The apparatus according to claim 1, further comprising an acceleration sensor for detecting an acceleration of said anti-vibration table,

wherein said anti-vibration table displacement controller generates the driving signal for said servo
20 valve on the basis of an output from said displacement sensor and/or said acceleration sensor, so that said anti-vibration table keeps the predetermined posture at the predetermined position.

5. The apparatus according to claim 1, wherein at least
25 one of a target position and a target speed of said movable portion is feed-forwarded to said anti-vibration table displacement controller and said anti-vibration table

vibration controller.

6. The apparatus according to claim 1, wherein a signal
that filters at least one of a target position and a target
speed of said movable portion is feed-forwarded to said
5 anti-vibration table displacement controller and said
anti-vibration table vibration controller.

7. The apparatus according to claim 6, wherein
the filter includes first and second high-pass
filters, and

10 a signal obtained by passing the target speed of said
movable portion through the first high-pass filter and a
signal obtained by passing the target position of the
movable portion through the second high-pass filter are
feed-forwarded to said anti-vibration table displacement
15 controller and said anti-vibration table vibration
controller, respectively.

8. The apparatus according to claim 6, wherein
the filter includes low- and high-pass filters, and
a signal obtained by passing the target speed of said
20 movable portion through the low-pass filter and a signal
obtained by passing the target position of the movable
portion through the high-pass filter are feed-forwarded to
said anti-vibration table displacement controller and said
anti-vibration table vibration controller, respectively.

25 9. The apparatus according to claim 6, wherein
the filter includes first and second low-pass filters,
and

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- a signal obtained by passing the target speed of said movable portion through the first low-pass filter and a signal obtained by passing the target position of the movable portion through the second low-pass filter are
- 5 feed-forwarded to said anti-vibration table displacement controller and said anti-vibration table vibration controller, respectively.
10. The apparatus according to claim 6, wherein the filter includes a low-pass filter, and
- 10 a signal obtained by passing the target speed of said movable portion through the low-pass filter is feed-forwarded to both said anti-vibration table displacement controller and said anti-vibration table vibration controller.
- 15 11. The apparatus according to claim 7, wherein cutoff frequencies of both of said first and second high-pass filters are substantially equal, and each of the respective cutoff frequencies has a predetermined value in a controllable frequency range of said pneumatic spring.
- 20 12. The apparatus according to claim 8, wherein cutoff frequencies of both of said low- and high-pass filters are substantially equal, and each of the respective cutoff frequencies is a predetermined value in a controllable frequency range of said pneumatic spring.
- 25 13. The apparatus according to claim 9, wherein cutoff frequencies of both of said first and second low-pass filters are substantially equal, and each of the respective

cutoff frequencies is a predetermined value in a controllable frequency range of said pneumatic spring.

14. An exposure apparatus comprising:

a projection optical system for projecting a pattern
5 onto a substrate;

a stage for holding the substrate; and

an active anti-vibration apparatus with an anti-vibration table mounted under said stage, said active anti-vibration apparatus comprising

10 a movable portion mounted on said anti-vibration table,

a pneumatic spring for supporting and driving said anti-vibration table,

a servo valve for adjusting a pressure of said
15 pneumatic spring,

an electromagnetic actuator for applying a force to said anti-vibration table,

a displacement sensor for detecting displacement of said anti-vibration table,

20 an anti-vibration table displacement controller for generating a driving signal for said servo valve on the basis of an output from said displacement sensor so that said anti-vibration table keeps a predetermined posture at a predetermined position, and

25 an anti-vibration table vibration controller for generating a driving signal for said electromagnetic actuator,

- wherein both said servo valve and said electromagnetic actuator are so controlled as to compensate for movement of a load that occurs when said movable portion moves on said anti-vibration table.
- 5 15. A device manufacturing method comprising the steps of:
- applying a resist on a substrate;
 - drawing a pattern on the substrate with an exposure apparatus having an active anti-vibration apparatus, and
 - 10 developing the substrate,
 - the active anti-vibration apparatus comprising an anti-vibration table,
 - a movable portion mounted on said anti-vibration table,
 - 15 a pneumatic spring for supporting and driving said anti-vibration table,
 - a servo valve for adjusting a pressure of said pneumatic spring,
 - an electromagnetic actuator for applying a force to
 - 20 said anti-vibration table,
 - a displacement sensor for detecting displacement of said anti-vibration table,
 - an anti-vibration table displacement controller for generating a driving signal for said servo valve on the
 - 25 basis of an output from said displacement sensor so that said anti-vibration table keeps a predetermined posture at a predetermined position, and

an anti-vibration table vibration controller for generating a driving signal for said electromagnetic actuator,

- wherein both said servo valve and said
- 5 electromagnetic actuator are so controlled as to compensate for movement of a load that occurs when said movable portion moves on said anti-vibration table.

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